Amendments to Claims

1. (Currently amended) A reactor for the production of nanoparticles in an aerosol process comprising:

(a) a reaction chamber having a wall, an inlet and an outlet the inlet for introducing a hot carrier gas to the reaction chamber which hot carrier gas flows downward from the inlet through the reaction chamber and out the outlet,

(b) a quench zone located downstream of the reaction chamber having an inlet and an outlet,

(c) one or more quench inlets being positioned approximately about the outlet of the reaction chamber for introducing a quench material,

(d) ~~one or more~~ radially distributed reactant inlets positioned between the reaction chamber inlet and the quench inlets for introducing one or more reactants;

the reaction chamber comprising a spacer zone and a homogenization zone: (i) ~~a~~the spacer zone having a length, L1, extending from the reaction chamber inlet and ending approximately about the reactant inlets having an upper diameter converging, upstream of the reactant inlets, to a lower diameter tubular region, the spacer zone having a recirculation zone, the reactant inlets being downstream of the recirculation zone and positioned to introduce reactants into the tubular region which tubular region extends into the homogenization zone, and (ii) ~~a~~the homogenization zone ~~having~~ including the tubular region which is followed by a converging section which converges to a nozzle tip, the homogenization zone having a length L2 extending from approximately the location of the reactant inlets and ending approximately about the quench zone inlet; the spacer zone for allowing the hot carrier gas to carry the reactants downward towards the homogenization zone, the homogenization zone for contacting the reactants under conditions suitable for forming a reaction product and passing the reaction product to the quench zone, L1 being sufficient for the hot carrier gas to attach to the wall of the spacer zone of the reaction chamber prior to the reactant inlets and L2 being sufficient for a residence time of the reactants within the homogenization zone suitable for forming the reaction product which when withdrawn from the outlet of the quench zone are nanoparticles.

2. (Original) The reactor of Claim 1, which further comprises a high temperature heating means for heating the carrier gas selected from the group consisting of a DC plasma arc, RF plasma, electric heating, conductive heating, flame reactor and laser reactor.

3. (Original) The reactor of Claim 1, which further comprises a DC plasma arc for heating the carrier gas.

4. (Original) The reactor of Claim 1, which further comprises an RF plasma for heating the carrier gas.

5. (Original) The reactor of Claim 1, wherein the reaction chamber further comprises a homogenizer which provides the spacer zone and the homogenization zone.

6. (Original) The reactor of Claim 5, wherein the homogenizer is constructed of copper or ceramic material.

Claims 7-16 cancelled.

17. (Currently amended) A reaction chamber for minimizing flow recirculation in a reactor for the production of reaction product nanoparticles, the reaction chamber comprising a wall, an entrance and an exit ~~wherein, in the vicinity of the exit, the wall of the homogenizer converges to a nozzle tip from which the reaction product nanoparticles are withdrawn,~~ a hot carrier gas inlet located about the entrance of the reaction chamber and quench material inlets located about the exit of the reaction chamber and ~~one or more~~radially distributed reactant inlets located between the hot carrier gas inlet and the quench inlets, the reactant inlets being located downstream of a recirculation zone created by the hot carrier gas as it flows downward from the hot carrier gas inlet toward the reactant inlets, the hot carrier gas inlet and reactant inlets being oriented for a downward flow direction of the hot carrier gas and reactants, the ~~homogenizer~~reaction chamber comprising a spacer zone and a homogenization zone~~having~~ (i) ~~a~~the spacer zone having a length, L1, extending from the reaction chamber entrance and ending about the reactant inlets having an upper diameter converging, upstream of the reactant inlets, to a lower diameter tubular region which reactant inlets are positioned to introduce reactants into the tubular region the tubular region extending into the homogenization zone, and (ii) ~~a~~the homogenization zone ~~having~~ including the tubular region followed by a converging section which converges to a nozzle tip and having a length L2 extending from the reactant inlets to a position downstream of the quench inlets for contacting the hot carrier gas and the reactants and wherein L1 of the spacer zone is sufficient for the hot carrier gas to attach to the wall of the reaction chamber before the hot carrier gas reaches the reactant inlets and L2 of the reaction chamber being sufficient for a residence time within the homogenization zone suitable for forming the reaction product nanoparticles.

Claim 18 canceled.

19. (Currently Amended) An aerosol process for producing nanoparticles, comprising the steps:

(a) introducing, in a downward flow direction, a carrier gas into a reactor chamber, the reactor chamber having (i) axially spaced inlet and outlet ends along the reactor axis wherein positioned at the inlet end of the reactor chamber is a high temperature heating means to heat

a carrier gas having a flow direction axially from the ~~reaction~~reactor chamber inlet downstream through the ~~reaction~~reactor chamber and out the chamber outlet and wherein one or more quench gas inlets are positioned up stream from the outlet end of the reactor chamber for introducing a quench gas for cooling; and (ii) a reaction chamber having an axially spaced entrance and an exit wherein in the vicinity of the exit, ~~the homogenizer converges to a nozzle tip,~~ the entrance of the ~~homogenizer~~reaction chamber being aligned with the inlet to the ~~reaction~~ reactor chamber and ~~the~~a homogenizer being inserted within the reaction chamber and held in place by a homogenizer holder such that the homogenizer extends from the inlet end of the reaction chamber securely fitting against the inlet end for at least a portion of the homogenizer's overall length and wherein the homogenizer compris~~ing~~es two zones a spacer zone and a homogenization zone: (i) ~~a~~the spacer zone having a length, L1, extending from the reaction chamber entrance and ending about ~~where one or more~~the reactant inlet tubes ~~are positioned, after having passed~~which pass through a wall of the reaction chamber, to deliver one or more reactants into the reaction chamber so the reactants contact the hot carrier gas, the spacer zone having an upper diameter converging, upstream of the reactant inlets, to a lower diameter tubular region, the spacer zone having a recirculation zone, the reactant inlets being downstream of the recirculation zone and positioned to introduce reactants into the tubular region and (ii) ~~a~~the homogenization zone including the tubular region which is followed by a converging section which converges to a nozzle tip, the homogenization zone extending from the reactant inlet tubes' location to a position down stream of the quench gas inlets; and wherein carrier gas and reactants mix and react in the homogenization zone and pass through the flow homogenization exit nozzle to enter a quench zone of the ~~reaction~~reactor chamber defined by the quench gas inlet location in a ~~reaction~~reactor chamber wall and the ~~reaction~~reactor chamber outlet and wherein L1 of the spacer zone must be long enough to have the hot gas flow attached to walls of the reaction chamber before the hot gas reaches the reactant inlets and the overall length (L1 + L2) of the reaction chamber is designed to a residence time sufficient that the following ~~three~~ tasks are completed before gas flow ~~exiting~~exits the homogenizer: (1) gas flow in the reaction chamber has achieved a near one dimensional flow and concentration profile; and (2) gas-phase nucleation of nanoparticles has been initiated;

(b) heating the carrier gas by thermal contact with the heating means to a temperature to initiate reaction of the carrier gas with one or more reactants;

(c) introducing one or more reactants through the reactant inlet tubes to form a reaction mixture;

(d) adjusting flow rates of the carrier gas and reactants such that reaction mixture flows through the flow homogenization ~~chamber~~zone at a rate such that (1) flow of the reaction

mixture is characterized by one-dimensional flow and a one dimensional concentration profile; and (2) gas-phase nucleation of the nanoparticles has been initiated;

(e) immediately injecting quench gas through the quench gas inlet tubes as the reaction mixture flow enters the quench zone so that nanoparticle coagulation and coalescence~~s~~ is reduced and temperature of the reaction mixture and the nanoparticles is decreased; and

(f) separating and collecting the nanoparticles.

Claims 20-22 Cancelled.

23. (Previously presented) The reactor of claim 1 wherein the reactor is a subsonic reactor.

24. (Previously presented) The reactor of claim 1 wherein the hot carrier gas which flows out the outlet has a gas pressure at the outlet in the range of 1-5 atmospheres.

25. Cancel.